



Indoor Air International

International Conference

**Priorities for Indoor Air
Research and Action**

29-31 May 1991

**Hyatt Continental Hotel
Montreux, Switzerland**

**Paper
Abstracts**

2025826037

The International Association for Indoor Air Quality
Postfach 2, CH-4467 Rothenfluh, Switzerland

ABSTRACTS

A1

Urinary effects of metallic air pollutants in school children.
S. Attenoux, F. Grimaldi, A. Botta, E. Muls, J. Pompili &
A. Viala, Facultes de Medicine et de Pharmacie, Marseille, France.

A study of the nephrotoxicity of metallic air pollutants in children was carried out. Lead and cadmium were analyzed in air samples by electrothermal atomic absorption spectroscopy during 9 months outside and inside two nursery schools, one in the open country (La Tour d'Aigues:T.A.), the other in the north of Marseilles (N.M.) close to a wire factory and an urban street. Lead and cadmium pollution was much lower in T.A. than in N.M. The indoor versus outdoor ratios were 0.53 and 0.79 for lead and 0.73 and 0.57 for cadmium, respectively.

Urinary delta-aminolevulinic acid (ALAU), a bio-marker of lead, and urinary cadmium (CdU) were determined monthly in the children by colorimetry and ICP respectively. The concentrations were significantly higher in N.M. than in T.A. in 5/9 assays for ALAU and 2/9 assays for CdU. ALAU levels were found to be above 6 mg/g creatinine (standard value in a non-occupationally-exposed population) for 3.6% of the measurements in T.A. children and 11.2% in N.M. children. All ALAU levels, however, were under 20 mg/g creatinine (maximum value tolerated in exposed workers). It appears that a greater air lead level may result in higher ALAU. For CdU, 7.2% (T.A.) and 11.6% (N.M.) of the levels were found to be above 2.5 ppb (detection limit of the ICP method and also the maximum value in a non-occupationally-exposed population and non-smokers). 3% (T.A.) and 5.4% (N.M.) of the levels were above 10 ug/g creatinine (the allowable value in exposed workers). CdU levels were not usually related to air cadmium levels. This suggests that other factors, or other sources of cadmium, have to be considered in the investigated children.

A2

Air protection in industrial premises at work with highly toxic substances.

N. Bitcolov & V. Zharkov, Department of Technical Sciences,
Laboratory for Industrial Aerology, Research Institute of Sea
Transport Hygiene, Leningrad, USSR.

Protection from highly toxic substances in indoor air can be achieved by adequate planning of industrial premises (designing one-, two- and three-zone ventilation), isolation and hermetization of equipment, and designing local and general ventilation systems. The degree of isolation of premises is determined by the protection coefficient. Its value depends on the concentration of pollutants in relation to the air flow of given premises and adjoining ones. The protection coefficient values for different types of premises planning, protective equipment and other engineering solutions were obtained by means of simulating air flow with gases. The protection coefficient depends on air flow rates through openings, their size, energy dissipated by air flow and other factors. The protection coefficient which is the product of coefficients corresponding to local ventilation, general ventilation, etc., may be used to evaluate the efficiency of measures for providing good air quality. Designing clean and dirty zones in industrial premises makes it possible to provide air protection from 1 to 3 orders, local ventilation - 1-2 orders, general ventilation - within 1 order.

2025826038

A3

The Impact of Increased Ventilation Upon Indoor Air Quality.
C. Collett, J. Ventresca & S. Turner, Theodor D Sterling and
Associates Ltd, Vancouver, B.C., Canada

This paper presents a case study assessment of the impact of increased minimum outside air ventilation upon indoor air quality. Indoor environmental conditions were monitored during two three-day test periods in a 19 storey office building in Columbus, Ohio. Prior to, and during, the first test period, the minimum outside ventilation rate was set at 5 cubic feet per minute (cfm) per occupant. In the second test period, the minimum outside air ventilation rate was increased to 20 cfm/occupant. These two test ventilation rates were selected to represent the different minimum ventilation rates recommended in ASHRAE ventilation standards 62-1981 and 62-1989. Instantaneous measurements of carbon dioxide, carbon monoxide, temperature, relative humidity, and respirable particles were taken twice at each sampling location on every day of testing (first in the morning, repeated in the afternoon). Integrated sampling for formaldehyde nicotine, and total volatile organic compounds was conducted at selected sampling sites on each test day. Airborne microbial sampling was performed at all locations on the first and third test days of each week. Occupants also completed a questionnaire designed to measure perceived air quality and comfort conditions. This paper will evaluate the differences in both measured and perceived indoor environmental conditions between the two ventilation operating conditions of 5 cfm/person and 20 cfm/person.

A4

Asbestos in Indoor Air and its Significance: Identification of possible Control Requirements.
B.T. Commins, Maidenhead, Berkshire, UK.

Asbestos has been used for a variety of purposes inside buildings. Some asbestos is 'locked-in' because it forms a matrix with other materials, eg. with plastics, resins, or cement; in contrast, pure unbonded asbestos has also been used, for example for insulation purposes. Some asbestos products may become damaged leading to the release of some asbestos fibres to indoor air. In regard to asbestos exposure and risk, a number of misconceptions exist. However following extensive investigations, important conclusions can now be drawn regarding indoor air exposure to various forms of asbestos and products containing it. In general the predicted risk seems to be very low. Often no action is required but in some cases where serious deterioration of certain types of asbestos product has arisen, remedial measures such as sealing, encapsulation, or even removal (especially prior to building demolition) may be required. It is essential to use proper controls for carrying out any remedial measures (a) to prevent all workers involved from being exposed to undesirable levels of asbestos dust (b) to prevent the general public living nearby from being exposed whilst the work is being carried out or afterwards (c) to ensure that environmental contamination does not arise from the disposal of asbestos waste materials. Priority situations regarding asbestos in indoor air can now be identified and criteria specified in relation to possible actions; where a potential risk is definable this can be assessed in perspective with other known low-level risks which society is faced with.

2025826039

A5

Occupational Exposures and Bladder Cancer.

G. Crepat, Departement de Biologie Appliquee, Institut
Universitaire de Technologie, Universite de Bourgogne, Dijon,
France.

Bladder cancer is the fifth most common cancer in man: it causes 4,000 deaths/year in France and more than 10,000 deaths/year in the USA. Several studies have investigated the occupational risk factors for bladder cancer while controlling for diet, cigarette smoking, drug consumption and the drinking of coffee, tea, spirits and beer. About thirty such case-control studies, conducted in ten different countries, have been compared and the levels, and consistency, of relative risk values considered in several high risk occupations. Exposures occurring in textile, engineering, chemical and graphic industries result in a 50% increase in bladder cancer risk and are directly responsible for 10 to 30% of bladder cancer deaths. In occupations exposed to dyestuffs, fumes, petroleum products, rubber, tar, asphalt, coal and hot metal, there is a two to threefold increase in relative risk values. Chemical compounds directly involved are : aromatic amines; PAH; PAHs; arylamines; BNA; NOC; asbestos; metals (Al, Cr, Zn, Pb).

An understanding of the relationship between occupational risks and bladder cancer as well as the etiological mechanisms (initiators or promoters) leads to the conclusion that bladder cancer could be greatly reduced by controlling occupational exposures.

A6

Landscape Architecture: An Appropriate Alternative for Air Quality Control in Developing Countries.

L.M. Ferrer, College of Architecture & Fine Arts, University of Santo Tomas, Manila, Philippines.

The lessons of the energy crisis of the seventies and the repercussions of the recent Gulf War are reason enough for developing countries to look for appropriate alternatives to energy-dependent and costly methods and equipment for air quality control.

Artificial ventilation and air filtration may be necessary in some specific situations. Such methods of air quality control, however, are not accessible to many people in most developing countries and economies. Removal of contaminants and dilution of contaminated air with uncontaminated air are two general methods of controlling air quality especially in enclosed spaces. Air quality control equipment generally functions by these methods. Plants by their functional use can serve the same purpose.

Landscape architecture, by combining architectural principles with the functional purpose served by plants, is an appropriate means for air quality control. More-focussed research and action are needed to harness landscape architecture as an appropriate means of air quality control especially in developing countries.

2025826040

A7

Relationship between occupants' discomfort as perceived by them and as measured objectively.

F. Haghighat, R. D'Addario & G. Donnini, Center for Building Studies, Concordia University, Montreal, Quebec, Canada.

This paper examines the relationship between the indoor environment parameters as perceived by the occupants of two floors in a ten-storey building and as measured objectively. The parameters measured were dry-bulb temperature, relative humidity, total dust and the levels of formaldehyde, VOCs and CO₂.

Questionnaires were also distributed to the building occupants. All parameters and questionnaires were recorded on both floors over a five-week period, and analyzed simultaneously. Our investigation showed that complaints reported by the occupants were associated with perceived, rather than measured, levels of indoor environmental parameters.

A8

A Case Study on Measurement of Indoor Aldehydes on a University Campus.

Y Hashimoto, S. Tanaka & K. Morikami, Department of Applied Chemistry, Faculty of Science and Technology, Keio University, Yokohama, Japan.

Indoor aldehydes were collected on a Sep-PAK cartridge impregnated with 2,4-dinitrohydrazine and analysed by high pressure liquid chromatography. Once-a-month measurements were made at various places such as a chemical laboratory, an office, a cafeteria, and a library on the campus of Keio University, Yokohama, Japan for 12 months from April 1989. The indoor air concentrations of formaldehyde and acetaldehyde were 0.13-0.43 ppm and 0.03-0.04 ppm; the range reflecting a decrease in day-, compared with night-time, values, perhaps the result of ventilation during day-time working hours. Maximal outdoor levels of formaldehyde and acetaldehyde at 0.04 ppm and 0.01 ppm, respectively, were lower than indoor levels. In a building whose construction had been completed in April, the concentrations of aldehydes showed a peak in June to September, and decreased thereafter. Emission from buildings and furniture, the possible sources of aldehydes in air, appeared to be temperature-dependent. In the cafeteria, the concentrations of aldehydes reached maximum values between 13.00 and 14.00. It was concluded that the major emission sources of aldehydes were building materials and smoking, except in experimental laboratories where organic chemicals may have been the main source.

2025826041

A9

Health problems due to indoor air pollutants in occupational settings.

F. He, Institute of Occupational Medicine, Chinese Academy of Preventive Medicine, Beijing, China.

Since 1987, there have been 102 prescribed occupational diseases on the official list of such issued by the Chinese Ministry of Public Health. Of these diseases, 83 are induced by indoor air pollutants.

Based on the national reporting system for occupational diseases in China, the most prevalent acute occupational poisonings are related to carbon monoxide exposure, followed by hydrogen sulfide, chlorine and aniline exposures. Acute carbon monoxide poisoning occurs not only in coal miners, steel workers and fertilizer manufacture workers, but also frequently in the homes of inhabitants of north China in winter because of indoor coal fires used for heating and cooking. Mortality from acute occupational carbon monoxide poisoning is also among the highest for acute poisonings. Of chronic occupational poisonings in China, lead poisoning leads, with a much higher prevalence in township- and village-owned small factories than in state-run enterprises. Pneumoconioses are the major occupational diseases induced by indoor dusts from such things as silica, coal and asbestos. In China, there are about 20,000 new cases of pneumoconioses per year. However, effective treatments are lacking.

Obviously, reducing indoor air pollution, developing environmental and biological monitoring, and early detection and surveillance of exposed subjects should be the priorities for research and action which will lead to the prevention of occupational diseases due to indoor air pollutants in China.

A10

Costs of Better Ventilation Compared to Decreased Absenteeism Savings.

L.C. Holcomb & J. Pedelty, Holcomb Environmental Services, Olivet, MI, USA.

A combination of "tight" buildings with little fresh air ventilation and inadequate ventilation system maintenance can produce an indoor environment in which relatively high levels of chemical contaminants, bacteria, fungi and dust are not uncommon. Levels of contaminants in the air can often be several times higher indoors than outdoors. Since most adults spend approximately 90 percent of their time indoors, it is clear that the major exposure to these contaminants is likely to be from indoor sources.

Poor ventilation and poor indoor air quality are believed to lead to an increased incidence of respiratory disease or similar symptoms and, in turn, lead to an increase in absenteeism and a loss of employee productivity. There have been no attempts to quantify the costs or potential savings which may be realized by improving building ventilation and attempting to decrease employee absenteeism and/or improve employee productivity. A computer program which utilizes data from recent publications on indoor air quality, absentee rates and ventilation costs has been developed. Using current literature data and building-specific information, it will calculate the cost of increasing the ventilation in a poorly ventilated building and compare that cost to the expense of lost employee time which may result from poor ventilation conditions. Substantial, over-all savings can be expected from improved ventilation conditions.

2025826042

A11

Environmental Tobacco Smoke Exposure and Respiratory Health in Children: An Updated Critical Review and Analysis of the Epidemiological Literature.

R.D. Hood, J.M. Wu, R.J. Witorsch & P. Witorsch, University of Alabama, N.Y. Med. Col., Va. Commonwealth U., George Washington U., USA.

The issue of ETS exposure to children and respiratory health effects remains a matter of considerable controversy. We undertook to conduct a comprehensive and updated critical review and objective analysis of the epidemiological literature relevant to possible associations between ETS exposure and respiratory health of children. There appears to be a consistent association between parental (primarily maternal) smoking and respiratory symptoms and certain disease in pre-school children (44 reports). On the other hand, there is no consistent association between parental smoking and 1) respiratory symptoms or disease (46 reports), 2) middle ear disease (17 reports), 3) pulmonary function (38 reports), or 4) lung growth and development (5 reports) in school-age or older children. Possible explanations for these data and the age-related differences noted include 1) an ETS effect, with age-dependent variations in susceptibility and/or exposure to ETS, 2) pregnancy and/or lactational effects of maternal active smoking, 3) inaccuracies related to unvalidated clinical data and smoking status misclassification, and 4) variable treatment of SES-related and other confounding factors. The available data relative to these issues is inconclusive, and which of these explanations pertain remains to be determined by further research.

A12

Follow-Up Study of Thermal Insulation of a Church on its Indoor Air Quality: Soot from Candles and Incense as Source of Pollution. Building Design and Ventilation as corrective measures.

C.K. Huynh^a, T. Vu-Duc^a, M. Guillemin^a, H. Savolainen^a & F. Iselin^b, ^aInstitute of Occupational Health Sciences, University of Lausanne, Lausanne, Switzerland. ^bSwiss Institute of Technology, Department of Architecture, Lausanne, Switzerland.

A 10,000 m³ Gothic medieval church in Geneva had been restored in 1930, heated by the floor in 1980 and well insulated to reduce the heating costs in 1985. Three years after the last renovations, the internal surfaces of the naves were covered by a dark dust, necessitating costly cleaning after 3 years compared with the customary 10-12 year cycle. The church is in a small square, encircled by three major streets, and 50,000 cars pass by daily. External expert opinion was that the outdoor traffic was the source of the indoor pollution. Our investigation, based on chemical analysis of lead and polycyclic aromatic hydrocarbons (PAH) in sedimented dust, showed soot from incense and candle combustion to be the principal cause. Incense appears to be a significant source of carcinogenic PAHs. The relation between the burning of incense during mass and the increase of suspended dust concentration in the church was shown by a real-time aerosol monitor. According to our proposals, a further architectural study and a mechanical ventilation system were investigated in 1989. Residence time of suspended dust in the church and the indoor air quality were determined before, and 1 year after, the modification. A sample survey was carried out with users of the church. Total cost of renovation, heating, cleaning and supplement ventilation versus air quality will be presented and discussed.

2025826043

A13

Sick Building Syndrome: A Way Forward, Comfort & Health.
P. Sherwood Burge, Solihull Hospital, West Midlands, UK.

Standards for indoor air quality are based on assessments of comfort and take no account of health. At least in the UK, the thermal comfort parameters are separate for temperature, humidity and airflow, requiring airconditioning to keep the temperature within comfort levels in the summer. Studies of the sick building syndrome have shown that buildings which conform better to the comfort standards (for instance most airconditioned buildings) perform less well than naturally ventilated buildings from the point of view of health were in general airconditioned buildings cause more problems than naturally ventilated buildings. The evidence of this in several large European studies will be reviewed. There are several theories relating to possible causes of sick building syndrome. So far it has not been possible to differentiate between sick and healthy buildings in terms of a number of measured parameters such as fresh air rate, volatile organic compounds, formaldehyde, ozone, carbon dioxide levels etc. There is an interesting relationship between fungal levels in indoor air and sick building syndrome. The highest levels are found in naturally ventilated buildings (where symptoms are less). However, within airconditioned buildings the sicker buildings have higher levels than the healthier buildings. However, filtering the fungi out in clean rooms does not resolve the problem. It is possible that some soluble product for instance a mycotoxin or a biocide is responsible.

Recent studies have shown that particularly in naturally ventilated buildings, poor cleaning is associated with symptoms and that this can be improved by better cleaning. It is likely that the sick building syndrome will be brought under control by better building design allowing more individual control and more adaptability of the building space and also by improving the standards of maintenance of existing plant.

A14

Indoor and Outdoor Air Pollution Measurements in Korea.
Y.S. Kim, College of Medicine, Hanyang University, Seoul, Korea.

The indoor air concentrations of nitrogen dioxide, formaldehyde, carbon monoxide, particles, and radon were measured at selected homes, underground shopping stores, and other microenvironments in Seoul, Korea during June 1989 -December 1990. Outdoor levels for each pollutant were compared with indoor levels in these selected environments. The mean concentration of each pollutant in the living rooms of the homes exceeded the mean levels outside. indoor/outdoor ratios for NO₂, HCHO, CO, particles, and radon were 1.1-4.9. The impact of several important characteristics of the selected indoor environments on the indoor levels of these pollutants should be evaluated.

2025826044

A15

Mechanical Ventilation: An Answer to the Radon Problem in Normal Conditions.

H. Kokotti & P. Kalliokoski, Department of Environmental Sciences, University of Kuopio, Kuopio, Finland

In our former study, we investigated houses that were similar in construction, but had different ventilation systems (1). Radon entry was found to increase linearly with increasing outdoor/indoor pressure difference irrespective of the type of ventilation system, when a threshold limit of 5 Pa was exceeded. These houses were quite tightly constructed from concrete elements on a slab. To obtain further information, the study is to continue in February and March of 1991 in houses having a different type of construction from those in the former study, and mechanical exhaust ventilation. The level of radon indoors and in soil gas is to be monitored continuously by Pylon AB-5 assembly. Data for analysis are to be downloaded to an MS-DOS-based computer system, using a Pylon computer interface and SP-55 computer software. Air pressures are to be determined with a manometer. Measurements of ventilation rates, temperature and humidity in the houses are also to be included in the study.

1. Kokotti H, Kalliokoski P, Raunemaa T. Short term and long term indoor radon concentrations in buildings with different ventilation systems. Environmental Technology Letters, 1989, 10: 1083-1088.

A16

Sources of Polynuclear Aromatic Hydrocarbons (PAH) in the Indoor Air of Hong Kong Homes.

L.C. Koo, J.H-C. Ho, H. Matsushita, H. Shimizu, T. Mori, H. Matsuki, S. Tominaga, Lung Cancer Research Unit, Hong Kong Anti-Cancer Society, Hong Kong.

As a pilot study to investigate the carcinogenicity of household dust in urban homes characterized by high rise buildings in close proximity, the kitchen and living rooms of 33 Hong Kong homes were monitored by an air sampler set at 20 liters/min to collect air for 24 hours. The collected dust was analyzed by HPLC for 7 PAH compounds: pyrene, BaA, BkF, BaP, BbC, BghiP, and Db(a,e)p, and then summed for a total PAH count in ng/m³.

The PAH levels in kitchens increased with cooking activities, incense burning, and smoke from neighbours. The use of gas water heaters and ventilating fans was associated with lower PAH levels, whereas it was higher when windows were opened. Incense burning was the major source of PAH in living rooms; cigarettes being a minor contributor. Homes with opened windows and doors had higher PAH levels. These data indicate that assessments of indoor air quality in homes must investigate emission sources as well as compensation behaviours, as the latter may override the effects of the former.

2025826045

A17

The rarely-diagnosed and progressive disaster of respiratory diseases.

G. Larouche, Montreal, Quebec, Canada.

In the 12th century, Moses Maimonides observed that the numbers of people having asthma was higher in cities and villages where the carcasses of animals were left to rot in the streets than in those where this was not the practice; he concluded that air pollution caused the asthma. However, in 1918, Rackerman suggested that asthma had no evident cause; he called it, "intrinsic", and almost all clinicians subsequently adopted this terminology. More recently, following their study of 2,000 cases of asthma, Burrows and co-workers (Burrows et al., 1989) came to the conclusion that asthma was, "extrinsic", and this view is supported by the work of Swartengren and co-workers (Swartengren et al., 1990) who examined atopy and asthma in monozygotic and discordant twins. Their findings led them to believe that both conditions were acquired, and not congenital. At present, cities have many "tight" buildings which have very little exchange between indoor and outdoor air. This can lead to an indoor build-up of chemical and biological agents which could result in the early tiredness etc. experienced by workers. The relationship of serious diseases such as Legionnaires' disease, pneumonia and humidifier fever to work-related asthma in office workers is rarely made since the asthmatic patient is likely to have his first attack at home, so leading the patient and doctor to believe that home is the site of the cause. The specialist cannot believe that such beautiful glass cages can have dangerous air inside. In 1987, 11,000 people died from asthma in North America. I will show what I collected in my office air last year. I will call for an IAI green peace for safe buildings now.

References:

F.R. Rackerman 1918

B. Burrows et al., 1989 New England Journal of Medicine

M. Swartengren et al., 1990 Annals of Allergy 16 (2)

A18

Factors that should be considered in the training of Building Services Engineers.

L.K. Quah, School of Building and Estate Management, National University of Singapore.

The integration and coordination of building services in the overall construction process has become more complex with the introduction of new materials and techniques of construction and the advent of sophisticated building services in the high tech buildings of today. The presence of an increasingly large building services retrofitting market presents problems of a different nature as well. Literature abounds on the plausible correlation between the quality of the indoor air, building related illnesses and the ventilation systems in buildings. Statistics on the operating expenditure of buildings indicate that maintenance of building services and utilities charges occupy a high proportion of the total operating costs. This paper discusses these interrelated issues and suggest that they require greater attention in the training of building services engineers.

2025826046

A19

Noise Problems In Singapore's Factories.

S.E. Lee, School of Building & Estate Management, National University of Singapore, Singapore.

For some time, noise-induced deafness has been the most prevalent industrial disease in Singapore, such that approximately 700 people are registered as suffering from noise-induced deafness every year.

A 3-year multi-disciplinary project was undertaken at the National University of Singapore to investigate the extent of problems due to noise in those industrial plants identified by the Environmental Health Department of the Government and by the Workers' Union as being noisy. The effectiveness of noise-control measures and of the design of those factories planned to improve acoustical performance was also studied. To date, noise-surveys have been carried out at over 136 factories to identify the noise sources that make a major contribution to the noise environment. Also, over 4,000 audiograms have been conducted under field conditions using mobile audiometric test facilities.

In the designated noisy plants, a significant proportion of the workers studied (26.7%) was shown to suffer from noise-induced deafness; the average permanent threshold shift in these workers was about 40-50 dB at between 4,000 and 6,000 Hz.

The noise survey has produced data that will be useful in the choice of production plants, in the planning of factories, to the owners of factories as well as to production engineers and safety officers.

A20

Control of Dust in Small Factories Owned by Rural Enterprises.

G.Q. Liu, C. Zhou, & J. Liu, Institute of Environmental Health and Engineering, Chinese Academy of Preventive Medicine, Beijing, China.

Rural industries have been developing rapidly in recent years and indoor and outdoor air pollution by dust from small factories has brought about hazardous effects on health and the environment. In the hope of solving these problems, the effectiveness of various ventilation techniques for controlling dust emission from various processes in small cement, ceramic, tile, glass and asbestos factories owned by rural enterprises has been studied. Emphasis was on the design of exhaust hoods and on which dust collectors were appropriate for different processes. A manual of exhaust hood designs of those hoods which had been used successfully in some factories was compiled, and many new hood designs were suggested to meet other requirements. Because the conditions and properties of dust from exhaust ventilation systems differ from each other, the type of dust collector must be selected according to specific requirements. Comprehensive surveys to measure the particle size and distribution of dust, and the characters of dust-laden gas (gas temp., moisture content or dew point temp. of gas and dust concentrations etc.) from various processes were carried out. Based on the results of these surveys, the experiences of air pollution control in small factories, and taking the economical situation and management into consideration, the best available dust collectors and their alternatives to be used for various processes are to be discussed.

2025826047

A21

A Review of Recent Progress of ETS Measurement in Japan.
Y. Ohkawa, Y. Akiyama, N. Takasu, Y. Yoshida, I. Ishii &
S. Fukuma*, Scientific Information Department, Japan Tobacco
Inc., Tokyo, Japan. *Chiba Cancer Center, Chiba, Japan.

Recently, the issue of Environmental Tobacco Smoke (ETS) has become a matter of great public concern. Because ETS may have a deleterious effect on health, it is extremely important that the levels of ETS and ETS exposure can be measured accurately. In this paper, recent studies of ETs and ETS exposure measurement which have been performed in Japan will be reviewed and the findings of the studies discussed. Kimura (1976) of the Institute of Science of Labour has examined indoor air pollution and found that cigarette smoking is important in the generation of particles. Matsukura (1979, 1984) of Kyoto University has established a radio-immunoassay procedure for measuring cotinine, and reported that, in non-smokers, the level of urinary cotinine increases with increase in ETS level. In 1980, Ishizu of JTI presented a general equation for the estimation of indoor pollution. This equation has since been extended so that the rate of generation of a pollutant can be estimated. Muramatsu (1984) of JTI has developed a nicotine personal monitor and, having measured nicotine in the air of various microenvironments, has found that ETS does not have a significant influence on the quality of indoor air in terms of its nicotine content. Higashi and Itani (1988) of Kyoto Senbai Hospital measured, using GC, nicotine and cotinine in the plasma and urine of smokers and non-smokers. In both plasma and urine, nicotine was found to be the more sensitive indicator of ETS uptake. Kasuga and Matsuki (1987, 1990) of Tokai University have measured urinary hydroxyproline and desmosine to indicate the level of ETS exposure. More recently, the same workers have studied the air quality of an aircraft cabin. Their preliminary results show that the levels of nicotine, the respirable particles and CO₂ at non-smoking seats are not as high as at smoking seats.

A22

Rural Houses: Neglected Indoor Air Problems.
A.-L. Pasanen^a, L. Leskinen^b & P. Kalliokoski^a, ^aDepartment of
Environmental Sciences, University of Kuopio, Kuopio, Finland.
^bCultor Ltd., Research Center, Kantvik, Finland.

Farmworkers are often heavily exposed to allergens such as fungal spores and storage mites in their work environment. Although farmers spend much of their time at home, this exposure will continue if allergens are carried home with them from work. In this study, airborne fungal spores were found in two farmhouses, and storage mites were identified in the dust from five farms. Counts of airborne fungal spores increased 4-14 fold in living rooms when farmers returned home from the cow barn. Dust removed from work clothes contained a great number of mites. The same species of fungi and mites were identified in farmhouses and barns. Thus, allergens seem to spread from barns to houses with work clothes. The indoor air quality of farmhouses requires careful consideration because, unlike at work, protective clothing is not worn routinely at home.

2025826048

A23

Health Effects of Improving Indoor Air Quality in the Workplace.
B.R. Reverente Jr., Philippine Refining Company Inc, Manila,
Philippines.

The results of dust monitoring in a soap and detergent factory was correlated with some health parameters of employees before and after measures were instituted to improve the quality of indoor air in the work environment. Dust monitoring was carried out by Galley dust samplers and the filters analyzed in the laboratory. Health was assessed by recording incidences of asthma or asthma-like symptoms, respiratory complaints, clinic consultations and sick leave. The results showed improvements in health after the institution of measures to reduce dust concentration in the workplace.

A24

Validation of a Modified ATS-DLD Questionnaire in the Diagnosis of some Chronic Lung Conditions.
C. Roa, Medical Center Manila, Ermita, Manila, Philippines.

A modified version of the American Thoracic Society DLD pulmonary questionnaire which incorporated direct questions on having bronchial asthma (BA) and pulmonary tuberculosis (PTB) was administered to 187 randomly-chosen clinic patients of the Philippine General Hospital. All patients had established diagnoses but these were not known to the trained non-MD interviewers. Employing the symptom complex that comprises the diagnosis of chronic obstructive pulmonary disease (COPD), the questionnaire had a sensitivity, specificity and positive predictive value (PPV) of 92%, 46% and 22%, respectively. On the question of having BA, the sensitivity, specificity and PPV of the questionnaire was slightly better at 91%, 55% and 38%. While the specificity of the questionnaire diagnosis of PTB was better at 66% and its PPV average at 36%, its low sensitivity at 78% limits its usefulness as a general screening tool for this condition. Several factors probably contribute to the low affirmative questionnaire response to PTB, among which is the social stigma the disease carries. The findings and implications of this study will be of value to those interpreting questionnaire-derived data on lung symptoms and diseases and, possibly, risk factors.

2025826049

A25

Building Form and Health in Naturally-Ventilated Dwellings.
H.J. Robertson, Department of Architecture, The Royal Institute of
Technology, Stockholm, Sweden.

The plan layouts of a group of forty dwellings associated with occupant health complaints were examined for spatial factors that could be contributing to symptoms. As the dwellings, in south-east Australia, were of a type in which ventilation tended to be wind-dominated all year round, it was possible that certain design factors could give rise to adverse effects of natural ventilation. No strong bias in orientation was indicated in living room or bedroom windows except as influenced by access roads, and there was almost no evidence of the use of solar planning principles. However, the trend for bathrooms used daily to be located away from the sun was general. In dwellings where the person reported to be most sensitive occupied a leeward bedroom, the predominance of windward bathrooms was pronounced. This was not so in dwellings where the most sensitive person occupied a windward orientated bedroom. In this sub-group, other design factors such as windward-facing external doors and leeward-site slopes appeared over-represented. Possible mechanisms by which building form could influence occupant exposure to indoor pollutants, such as microbial growth, moisture transfer or underventilation, were considered. Findings suggested that building form analysis could be useful in the development of healthy building planning principles for regions where sun and wind influence indoor climate for much of the year.

A26

The Incidence of Chronic Disease Among Home-makers, and Exposure to Hazardous Chemicals in the Home.
D. Sterling, T. Sterling, & C. Collett, Environmental/Occupational Health Program, Old Dominion University, Norfolk, Va, USA.

To determine the environmental risk factors for home-makers, the following information was ascertained by interview: health and work history; work practices; which chemicals were used in the home and whether the home-maker was exposed by any other possible hazards. A survey to ascertain which chemicals were in the home, together with their condition and storage location was also carried out. It was found that home-makers are exposed to a variety of toxic compounds at potentially-high concentrations, very often under poorly-ventilated conditions. These findings may explain the increase in chronic conditions (especially cancer) among home-makers, and may have confounded the findings of the parallel study, the U.S. Household Health Interview Survey, about health effects in employed women.

2025826050

A27

An Analysis of the Relationship between Radon, and Radon Daughter, Concentrations in Houses in Brittany and the Characteristics of the Subsoil, and an Investigation into the Source, and Distribution of Radon in such Houses.

G. Tymen¹, A. Mouden¹, M.C. Robe², J. Le Bronec² & A. Rannou².

¹Laboratoire de Physique des Aerosols et de Radioactivité Atmosphérique, Faculté des Sciences, Brest, France. ²Commissariat a l'Energie Atomique, IPSN/DPEI, France.

As a result of a national survey which has been carried out in France since 1983 to evaluate the concentration and distribution of radon in housing stock, special attention has been paid to regions suspected of presenting higher than average natural radiation levels. Thus, a special study has been conducted in Brittany, in the West of France, which is a 20 000 km² area crossed by a very old granitic formation. From 1984 to 1989 about 800 houses were monitored; for 2 week periods, integrated measurements were made of indoor radon gas and radon daughter concentrations, and indoor and outdoor gamma dose-rates were measured for 6-month periods. This paper will review the main results of this regional study, and examine the link between radon level and soil type. The study demonstrated that about 3-4% of houses investigated in this area presented ²²²Rn concentrations higher than the CCE recommendation of 400 Bq.m⁻³ and that this percentage increased in granitic areas. As a consequence of this study, further investigations were performed to identify more precisely the sources of radon and its distribution through houses where excessive concentrations have been identified. The methodology and results of these recent experiments will also be presented.

A28

Sensitization and small airways hyperreactivity among laboratory-animal workers.

S. Willers¹, U. Hjortsberg¹, J-A. Wihl² & P. Orbaek¹. ¹Department of Occupational and Environmental Medicine and ²Department of Otorhino-laryngology, Lund University, Malmö General Hospital, Malmö, Sweden.

Allergies and lung-function were investigated in 56 laboratory-animal workers. Although 30% of workers gave at least one positive skin prick test against laboratory-animals (RAST test was positive in 25%), 24% of these (RAST 21%) did not have animal-related symptoms. A medical history revealed that 32% of these had a laboratory-animal allergy (LAA; rhinoconjunctivitis and/or asthma) but 28% of these (RAST 39%) gave negative skin prick tests. An association with an increased risk for LAA was found for atopy, as indicated by a family history of allergy (relative risk, RR=6.7, confidence interval, CI=2.0-23 P=0.05), positive skin prick test against non-laboratory environmental allergens (RR=12, CI=3.0-45), positive phadiatop^R (RR=5.4, CI=1.4-21), and increased levels of serum IgE (>100 kU/l; RR=9.0, CI=1.9-42). Lung-function, measured as vital capacity and as forced expiratory volume in one second, was unchanged after a methacholine-provocation test. The nitrogen washout technique, however, showed a significant increase in the volume of trapped gas (VTG) at 0.1% methacholine among sensitized workers compared with non-sensitized healthy workers. Thus, animal allergen sensitization was found to be associated with a small airways disorder (VTG/TLC% 3.5 vs 1.8; p<0.01). Also, a positive phadiatop^R was associated with increased levels of VTG (VTG/TLC% 3.9; p<0.01).

2025826051

A29

A Protocol for the Analysis of Confounding Variables in Epidemiological Studies of the Respiratory System: Its Use in Studies of Parental Smoking Effects.

R.J. Witorsch, J.M. Wu, R.D. Hood, P. Witorsch. Va. Commonwealth. University, N.Y. Medical College, University of Alabama, & George Washington University, Washington DC, U.S.A.

A previous analysis of the influence of potential confounding variables in epidemiological studies (27 clinical, 26 PFT) of parental smoking effects on the respiratory system of school-age children revealed that 1) socioeconomic status and gas stove usage exhibited only minimal influences, and 2) parental respiratory illness and pulmonary performance, child's prior respiratory illness, and outdoor air pollution and humidity were consistently associated with respiratory effects in children (Wu et al., in press). In an extension of this work, a systematic protocol has been developed for the identification of confounding variables and their effects in individual epidemiological studies. This protocol was designed to: 1) identify all potential confounders; 2) determine how a particular confounder was assessed; 3) determine whether potential confounders exhibited independent effects; and 4) determine whether and how confounders influenced the association between parental smoking and respiratory effects in children. This instrument, available in standard word processing language, can be utilized directly with the aid of a personal computer. In our experience, this format appears to be an efficient method for the systematic identification and analysis of potential confounding variables in epidemiological studies in general. In addition to a detailed description of this protocol and its implementation, we will present a revised analysis of confounders on an expanded data base of epidemiologic reports (46 clinical, 38 PFT) of the effects of parental smoking on the respiratory system of school-age children.

A30

A Simple Method for the Determination of Benzene in Samples of Indoor Air.

M.L. Fiorentino, L. Maestri, S. Ghittori & M. Imbriani*, Fondazione Clinica del Lavoro, IRCCS, Centro Medico di Pavia, Italy. *Dipartimento di Medicina Preventiva, Occupazionale e di Comunità. II Sezione di Medicina del Lavoro-Università degli Studi di Pavia, Italy.

Since alicyclic and aliphatic hydrocarbons can interfere with the analysis of benzene in indoor air, a modified HPLC method for the detection of benzene has been developed. Conventional charcoal tubes have been used, but with methylene chloride (60%) and ethylacetate (40%) as the desorbing solvent mixture rather than carbon disulphide. When a small volume (100 μ l) of this desorbing mixture was injected into a gas chromatograph and detected by fluorescence (Ex 250 nm - Em 280 nm) neither alicyclic nor aliphatic hydrocarbon interference was observed. The detection limit of this method is about 0.1 μ g benzene: for a 20 L air sample, this corresponds to a detection limit of 5 μ u/m (1.5 ppb). This fluorescence method for the detection and analysis of benzene will be compared with a gas chromatographic method which employs a capillary column and flame ionization detector after collection of the air sample on a carbotrap 100 tube, and thermal desorption.

2025826052

A31

The Role of DNA Damage as a Biomarker in Risk Assessment for Carcinogens.

L.S. Levy, M. Gao & S.P. Binks, Institute of Occupational Health, University of Birmingham, Birmingham, UK.

The use of protein and DNA damage has become increasingly popular as a means of assessing both uptake and risk from exposure to a range of genotoxic occupational and environmental substances. The logic behind such a development is that if genotoxic agents cause detectable lesions which can be readily measured in blood or other tissues, and that these measurements act as a reliable surrogate for risk or an accurate measure of uptake, then preventive procedures such as implied by the UK Control of Substances Hazardous to Health Regulations, 1988 can be followed. However, there are a range of problems related to specificity and sensitivity that must be thought through before such 'litmus-tests' for exposure to potential carcinogens can be usefully applied. We have attempted to use one such biomarker, DNA strand breaks in peripheral lymphocytes, to examine the possible use of this technique to monitor workers, and others, who may be exposed to various forms of chromium-containing materials. In our investigations, we incubated human lymphocytes with genotoxic sodium dichromite (CrVI) and produced a dose-dependent increase in DNA strand breaks without concurrent cytotoxicity. In contrast, non-genotoxic chromium acetate hydroxide (CrIII) failed to produce strand breaks at sub-cytotoxic doses. In a concurrent study, intratracheal administration of doses up to the equivalent occupational exposure limit for CrVI to Wistar rats failed to produce DNA strand breaks but, such breaks were seen at higher concentrations. This provides some assurance in the safety of the current standard but more will need to be understood about chromium carcinogenesis as well as the specificity and sensitivity of the test system.

A32

Indoor Air in the Indian Context: An Agenda for Future Research.
V. Haraprasad, Energy - Environment Interface, Secunderabad, India.

Indoor air quality (IAQ) research priorities of tropical and developing countries are different from those of European countries where most of the IAQ problems are the result of energy-dependent buildings. This paper presents a review of IAQ research in India, and identifies areas for future research relevant to the country's geographic, cultural, socio-economic and climatic situation. This latter exercise is based on anticipated growth patterns over the next decade together with policies on shelter, energy, and the environment. Highlighted among the many areas identified for prospective research that could be carried out by designated agencies are the reduction of combustion emissions from biomass fuels, and the improvement of natural ventilation in buildings. An institutional mechanism to initiate, promote, coordinate, monitor and evaluate IAQ research in India is also outlined.

2025826053

A33

Desorption Kinetics of Trichlorethylene and Perchlorethylene from Cotton Fabrics.

L. Weber, Institute of Occupational and Social Medicine,
University of Ulm, Germany.

Trichlorethylene and perchlorethylene are still often used as degreasing and cleaning solvents in industry and at home. Chemical cleaning of clothes transports these solvents into flats. In a constant flow solvent exposition chamber cotton clothes in twisted and linen weave were exposed to trichlorethylene (114 ppm, 164 ppm and 246 ppm) and perchlorethylene (130 ppm - 282 ppm) over 6 hours. The loss of perchlorethylene after chemical cleaning and pressing was examined. The textile samples (100 mm x 100 mm) were carried several times and water cleaned before exposure. After solvent exposure in air the textile fabrics were ventilated at ambient temperature and humidity (50% rel.) on a dress hanger over 20 minutes. At 246 ppm (164 ppm, 114 ppm) of trichlorethylene exposition 5.1 mg/kg cotton (3.8;2.2 mg/kg) of the solvent was adsorbed. The loss of "tri" over 20 minutes was 50% (to 25%). Twisted cotton adsorbed 14-21 mg/kg, linen weave cotton 2.5-5.0 mg/kg fabric of perchlorethylene. Chemical cleaning delivers even higher amounts of perchlorethylene to atmosphere during pressing and storing before use. The source of tri- and tetrachlorethylene as environmental and indoor pollutants was identified as absorbed and retarded delivered solvents on clothes.

A34

Indoor Air Quality in Developing Countries.

A. Massoud & A.A. Karim, Department of Community Environmental and Occupational Medicine, Ain Shams Faculty of Medicine, Abbassia, Cairo, Egypt.

In the past, most studies on the quality of air have been concerned with examinations either of outdoor air, or the air in such work places as mines or industry. Although most of the population spends its time in buildings such as houses, schools and offices, the air in these types of buildings has received very little attention, and then predominantly in developed countries. In only a few developing countries are there regulations which govern air quality; where present, they tend to be drawn from those of developed countries without modifications to take into account local conditions. Bodies to carry out research into air quality and to execute regulations are often missing in developing countries, and, where they do exist, they tend not to be very competent technically.

Some studies carried out in Egypt have shown that the ratio of indoor to outdoor total suspended particle concentration increases from 1/2 to 4/5 in summer. Also, a village study has shown that, in houses using biomass combustion, the concentrations of CO₂, CO, NH₃, NO₂, NO and total hydrocarbons are very high.

It is clear that the quality of air, especially indoor air, needs special attention in developing countries. This may be achieved via the establishment of local scientific associations affiliated to international societies.

2025826054

A35

Contamination of Indoor Air with Mineral Fibres.

R.C. Brown & J.A. Hoskins, MRC Toxicology Unit, Woodmansterne Road, Carshalton, Surrey, UK.

Many buildings contain quantities of mineral fibres used as structural elements (especially in cement products) or as insulation. The aging of these products, their disturbance or removal can cause liberation of fibres into the indoor air. The health effects of these materials has been a subject of considerable concern with the cost and disruption involved in asbestos removal causing particular problems.

The type of fibres used in buildings will be described with an emphasis on the newer man-made fibres. These are used mainly as insulation wools, and do not become readily airborne; however, some preparations have caused disease in experimental animals. The relevance of these results to human risk assessment will be discussed. The levels of asbestos found in indoor air and the few data on the man-made fibres will be contrasted.

To cause disease, fibres must be of a certain size, have certain compositional properties and must be durable in animal or human tissue. The possibility of new materials having these dangerous properties has been made topical by results with refractory ceramic fibres and these results will be described.

Key words Asbestos, mineral fibres, animal experiments, risk assessment.

A36

Earth-Sheltered Architecture - An Alternative Way To Save Energy In Central And Eastern Europe.

P. Sobotka¹ & B. Kalina². ¹Department of Building Physics,

²Department of Economy, Faculty of Civil Engineering, Slovak Technical University, Bratislava, Czechoslovakia.

The present energy situation in Eastern Europe and, in particular, Czechoslovakia, will be considered. Since the construction of energy-efficient buildings is one possible means of limiting energy wastage, this presentation will analyse the possibility of a return, in this region, to one very effective type of building: the earth-sheltered dwelling.

The health records of long-term residents of rock-curved dwellings and of a similar group living in traditional houses will be compared.

The mean monthly indoor air temperatures of four rooms will be presented. The periods when the indoor air temperatures were at their maximum and minimum will be discussed and comparisons made of the indoor air temperatures of the two types of building when exterior conditions were similar.

An energy and economic analysis of the modern type of earth-sheltered dwelling will be presented, and suggestions made for administrative interventions.

2025826055

A37

Radon as an Indoor Air Hazard.

H.J. Dunster, London, UK.

The radioactive gas radon-222 is the immediate daughter of radium-226 which is present in soils, rocks, and building materials. The gas diffuses from these materials into our homes, where it decays into radioactive daughters. When these daughters are released into the air, they form aerosols, the form of which depends on the presence of condensation nuclei and dust particles already present. When radon and its daughters are inhaled, the radon is rapidly exhaled and does little damage. The aerosol particles carrying the radon daughters are deposited to varying degrees in the respiratory airways, where their alpha particles irradiate the nearby cells. It is the radiation dose to these cells that causes the risk of subsequent lung cancer.

Radon-induced lung cancer is well established as an occupational disease in several forms of mining, notably uranium mining where the data are sufficient to provide a quantitative relationship between exposure and the excess risk of cancer. The concentration in dwellings is usually, but not always, much lower than in mines and epidemiological studies have produced conflicting results. There is little doubt, however, that some of the higher concentrations do make a contribution to the incidence of lung cancer. Current views on the magnitude of the risk from radon in indoor air will be presented, together with an account of the actions recommended to limit the risk.

A38

Changes in the levels of maximum occupational exposure to benzene recommended by advisory bodies at different times.

G. Krstic, & D.F. Weetman, School of Pharmacology, Sunderland Polytechnic, Sunderland, England.

Although benzene is an established carcinogen in man, it is used in a number of industrial processes, thus presenting a potential hazard to workers. Levels of maximum exposure to benzene in the indoor air have been recommended by expert committees, in some cases with the support of appropriate legislation. In general, it is recommended that two levels of benzene in the air are not exceeded: a higher one for peak exposure, and a lower one that relates to exposure throughout a working day (usually an eight-hour time-weighted average). The recommended maximum permitted long-term exposure level of benzene in the ambient air has declined from 100 ppm in 1946 to 10 ppm today (American Conference of Governmental Industrial Hygienists). The changes in such recommendations are considered with respect to a: time, b: expert committee, and c: country, and are related to the toxicological database for benzene.

2025826056

A39

Immune disease associated with the indoor environment.
C.A.C. Pickering, Department of Occupational and Environmental
Medicine, Wythenshawe Hospital, Manchester, UK.

The prevalence of immunologically determined respiratory diseases is increasing throughout the world. The increased prevalence of bronchial asthma has been associated with an increased mortality from this disease. As a result there has been considerable interest in the factors which may influence the development of allergic disorders. The first few weeks following birth have been identified as important in determining the development of sensitivity to aeroallergens and subsequently the presence of allergic respiratory disorders. The expression of allergic diseases is predominantly genetically determined but is influenced to a significant degree by environmental factors related to indoor air quality. These factors include aeroallergen load, passive smoking and atmospheric pollution. If the present trend of increasing allergic problems in the community is to be curbed greater efforts will have to be made to improve domestic housing design to control for these various factors, particularly in families known to be at risk. As well as potentially initiating allergic disease in the postnatal period, poor indoor air quality may cause respiratory disease in later life. These diseases may be allergic in origin, such as bronchial asthma or allergic alveolitis, or may be infective in origin, such as Legionaire's Disease. The contamination of indoor air by microorganisms may occur from the structure of the building (including the ventilation system) or be introduced into the building from the outside air either via a mechanical ventilation system or through open windows. The offgassing of chemicals within buildings has attracted considerable attention over the past few years however the evidence that this process can cause immunological disease in man is very limited. If it occurs at all it is rare. Indoor air quality is an important potential cause of immunological respiratory disease in man which has been and still is frequently neglected.

A40

Health effects associated with the re-carpeting and painting of an academic library.

J. Munby*, J.R. Smy, D.F. Weetman, & N.P. Keaney¹, School of Pharmacology, Sunderland Polytechnic, Sunderland, England; and¹ Royal Infirmary, Sunderland, England.

The effect of changing the indoor environment of a small population (22) of librarians was investigated. The change was due to total re-carpeting and painting of a library building, which would be expected to introduce particles and volatile organic compounds into the indoor air. The refurbishing took 9 weeks; librarians and control subjects were investigated for 11 weeks, with assessments made both during and after the change. Lung function was assessed bi-weekly by recording the forced expiratory volume in one second (FEV₁). Peak flow rate was also measured by the subjects three times per day at midweek and weekends throughout the study to measure any diurnal variation in lung function, or effects due to acute exposure to particles, volatile solvents or paints. Subjects kept a daily diary of symptoms. Two librarians were matched by age and sex with one member of the control group, who worked in a nearby building that was not refurbished.

The design and findings of the study will be discussed.

2025826057

A41

The role of urinary nicotine and its metabolites as indicators of exposure to environmental tobacco smoke.

J.W. Gorrod, Chelsea Department of Pharmacy, Kings's College London, UK.

Recently, considerable effort has been made to correlate exposure to environmental tobacco smoke with levels of nicotine or its metabolites in biological fluids. Little attention has been given to alternate sources of nicotine nor has the complexity of mammalian nicotine metabolism and the factors controlling it been considered.

The primary metabolites of nicotine occur by either -C- or N-oxidation to yield cotinine, nornicotine or nicotine-1-N-oxide. The former reaction is mediated via a cytochrome P-450 process that yields nicotine: 1.5 iminium ion which is further oxidized by aldehyde oxidase to cotinine. The iminium ion has been trapped by reaction with CN and may itself be formed by loss of water from 5-hydroxy nicotine. N-demethylation of nicotine has also been shown to occur via an N-methylene iminium ion. Cis/trans nicotine-1-N-oxides are both formed by a flavin-containing amine oxidase; the cis/trans ratio being dependent upon the species and the organ used. Nicotine-1-N-oxide can be reduced to nicotine by the gut flora but is excreted virtually unchanged after i.v. administration to man. Cotinine is a substrate for N-oxidation of the pyridyl nitrogen producing cotinine-1-N-oxide by a cytochrome P-450 isozyme. Cotinine can be further oxidised to cis and trans-3-hydroxy cotinine and undergo ring opening of the pyrrolidone ring. The end product of nicotine metabolism appears to be pyridyl acetic acid arising from further biodegradation of cotinine metabolites. Nicotine and cotinine are also substrates for methylation reactions producing the corresponding quarternary N-methylpyridinium ions.

Recent evidence suggests that nicotine, cotinine and 3-hydroxy cotinine are excreted as glucuronic acid conjugates.

Some physiological, pathological and pharmacological factors affecting these pathways in man and experimental animals will be discussed.

I conclude that our present knowledge does not permit any extrapolation of either plasma or urinary levels of nicotine or any of its metabolites with exposure to tobacco smoke.

A42

Studies on the Nitrogenous Pollutants observed in the Air:

Magnitude of the Public Health Problem in Hungary.

M. Borzsonyi, National Institute of Public Health, Budapest, Hungary.

Nitrogen oxides are generated from many different nitrogen-substituted sources such as: monocyclic and polycyclic aromatic hydrocarbons; heterocyclic nitrates and nitroarenes. These compounds are found in outdoor and indoor air and appear to derive from vehicle exhaust emissions and photocopiers. The sources and formation and the mutagenic, genotoxic and carcinogenic activity of nitro compounds will be presented, and their importance in the environment will be discussed.

2025826058

A43

A New Approach to the Assessment of Indoor Air Quality.
M.J. Jokl, Technical University of Prague, Czechoslovakia.

In the microenvironment theory proposed by Jokl in 1989, the agents to which man is exposed are categorised according to the degree of a) physiological and b) psychological stress they induce. Scales for evaluating the two different types of stress are termed, "The Microenvironment Quality" and, "The Microenvironment Sensation" respectively: from these scales, ranges for what is optimal and for what is acceptable have been suggested. How the theory differs from Fanger's evaluation system will be illustrated by an examination of odor constituents.

A44

The Evaluation of Building and Furnishing Materials likely to cause Indoor Air Pollution.
A. Baglioni, N. Boschi, P. Carena & S. Piardi, Dipartimento di Programmazione e Produzione Edilizia (DPPPE), Politecnico di Milano, Facolta di Architettura, Milano, Italia.

Since all the materials involved in building construction and furnishing could lead to indoor air pollution, and testing individual items is time-consuming and expensive, it would be useful if a check-list were available for architects and builders which indicated the risk associated with each item. With the ultimate aim of producing such a list, workers at DPPPE have started by examining, in relation to their use in building and manufacturing processes and the methods of their installation, maintenance and cleaning, wooden, stone, and synthetic products used for floors and floor coverings.

A45

Characteristics of Indoor Airborne Particulates.
I.-F. Hung, C-C. Yu & C-J. Tung, Institute of Nuclear Science, National Tsing Hua University, Hsinchu, Taiwan, ROC.

The study of human exposure to indoor airborne particulates is becoming increasingly important because people spend most of their time indoors, and there are many indoor sources of airborne particulates.

In this study, airborne particulates in 3 different indoor environments: an office; a residence and a temple were sampled, and analyzed for their morphology, size distribution, and chemical composition. A quartz crystal microbalance cascade impactor was used to obtain direct readings of mass concentration and size distribution, and a four-stage cascade impactor was used to classify these airborne particulates into four different size ranges. Particulates deposited on stubs were analyzed by scanning electron microscope and energy dispersive x-ray analyzer for their shape, size, and chemical composition. The results have been used to identify the source of the airborne particulates found in the 3 different indoor environments under study.

2025826059

A46

Effect of design and workmanship of installations on indoor air quality.

D. Bienfait, Centre Scientifique et Technique du Batiment, Marne la Vallee, France.

This paper reviews some of the causes that may adversely affect the indoor air quality in a building. Design is concerned with factors such as: the effect of ventilation type on air humidity and related health problems; influence of open flues; possible air recirculation between air intakes and air exhaust; radon ingress; components fouling; humidifiers and cooling towers.

Workmanship is concerned with issues such as air leakage of building or ductwork and installation of air inlets.

Finally, taking notice that, for many ventilation designs, the air flowrates are not steady, some indications are given to account for this unsteadiness in the expression of flow rate requirements.

A47

The Relationship Between Indoor And Outdoor Air Quality.

M. Goldstone, J.N. Lester, R. Perry, J. Phillips & G.L. Reynolds, Environmental Engineering Laboratory, Imperial College, London, UK.

An assessment of indoor and outdoor air monitoring of organic compounds including VOCs, polynuclear aromatic hydrocarbons and other pollutants which arise from combustion sources such as motor vehicles and cooking will be made in relation to ventilation and to building design. the need for definitive research with respect to source definition and indoor air chemistry will be emphasised.

A48

An Examination of the System of Monitoring Adverse Health Effects of Air Pollution in Workplaces in Thailand.

M. Wongphanich*, N. Ankasuwapala** & C. Pongpanich**. *Department of Occupational Health, Mahidol University, Bangkok, Thailand.

**Occupational Health Division, Ministry of Public Health, Bangkok, Thailand.

In Thai workplaces where lead, manganese, organophosphates and silica are used, monitoring of the environment and of the state of health of the employees is carried out. Data obtained as a result of monitoring from 1982 to 1987 inclusive were compiled to determine whether the sensitivity of the monitoring process is such that a link can be made between exposure and adverse health effects. Bearing in mind the limitations of technology and finance, suggestions will be made for changes in the method of long-term monitoring.

2025826060

A49

Detection and Classification of Diseases due to Indoor Air Pollutants.

F.J.C. Roe, Wimbledon Common, London, UK.

Humans can survive, grow, and multiply even under conditions of appalling indoor air pollution. However, such pollution may shorten their lives and give rise to much morbidity during their declining years. Most but not all diseases attributable to indoor air pollution result from the inhalation of gases, irritant or allergenic dusts, or infectious organisms. The effects of such inhalation most commonly involve the upper or lower respiratory tract, but effects on other organs/tissues may also occur.

Absorption of toxins through the skin or via the gastro-intestinal tract may also occur as a result of indoor air pollution.

The extent to which spectra of effects of indoor and outdoor air pollution overlap varies with climate and affluence. Poorly designed and/or maintained air-conditioning systems in developed countries have introduced new problems, as has the introduction of new building materials and fabrics. The multifactorial nature of the aetiology of diseases of the kinds associated with indoor air pollution and the difficulties of distinguishing between disease and mere discomfort complicate the design and interpretation of epidemiological studies.

In this paper the detection of disease attributable to indoor air pollution is reviewed and an attempt is made to classify them.

A50

Establishing and Verifying Minimum VAV Air-Flow Rates.

M. Meckler, The Meckler Group, Encino, Ca, USA.

For a given indoor source of contaminants, the resulting indoor concentrations is largely a function of the building ventilation rates. Outside air taken into an occupied zone of a building cannot be assumed to be perfectly mixed with the indoor air, and this mixing is affected by several variables including the supply- and return-air distribution circuits, the rates of circulation, the outside air-flow, the mode of operation (e.g., cooling or heating), and the presence of indoor partitions, equipment and occupants.

The objective was the development and installation of appropriate measurements and control methods capable of determining the rates of delivery of outside, recirculated, filtered and cleaned, return air. These constitute the ventilation air of a typical variable-air-volume air-distribution system. This should result in specification of a measurement and analysis methodology, together with a description of instrumentation which will be capable of measuring minimum interior and exterior space cooling and maintaining temperatures for typical cooling load scenarios and associated space contaminant levels.

2025826061